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ABSTRACT

The theme of this document is that programmatic decision making can be carried out effectively only if appropriate kinds of information are made available. If an institution knows its objectives, it can define a course of action for the years ahead. Through use of a cost simulation model, it can forecast the resource implications of that plan. Student flow information will indicate which programs exhibit holding power and are most relevant to the needs and interests of the student population. Output measures can provide information related to the benefits or the value added to students and can be useful in identifying needed midcourse corrections. Planning and management systems can improve the management of resources allocated to higher education.
(Author/MJM)

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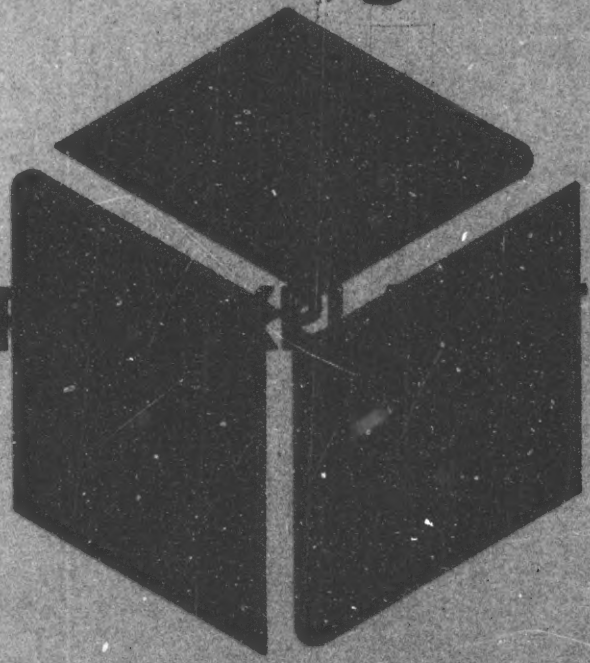
Higher Education Planning and Management Systems



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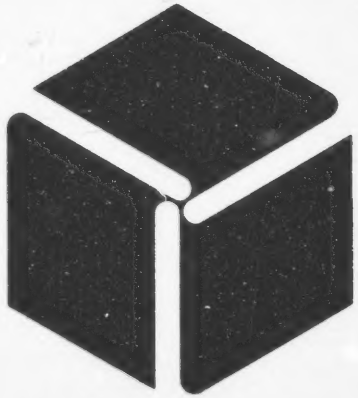

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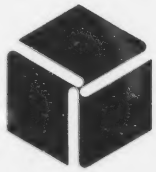


NCHEMS

- HOW ARE WE DOING?
- IS THE HIGHER EDUCATION PLANNING AND MANAGEMENT PROCESS CHANGING?

By
Robert A. Huff
Charles W. Manning

May, 1972

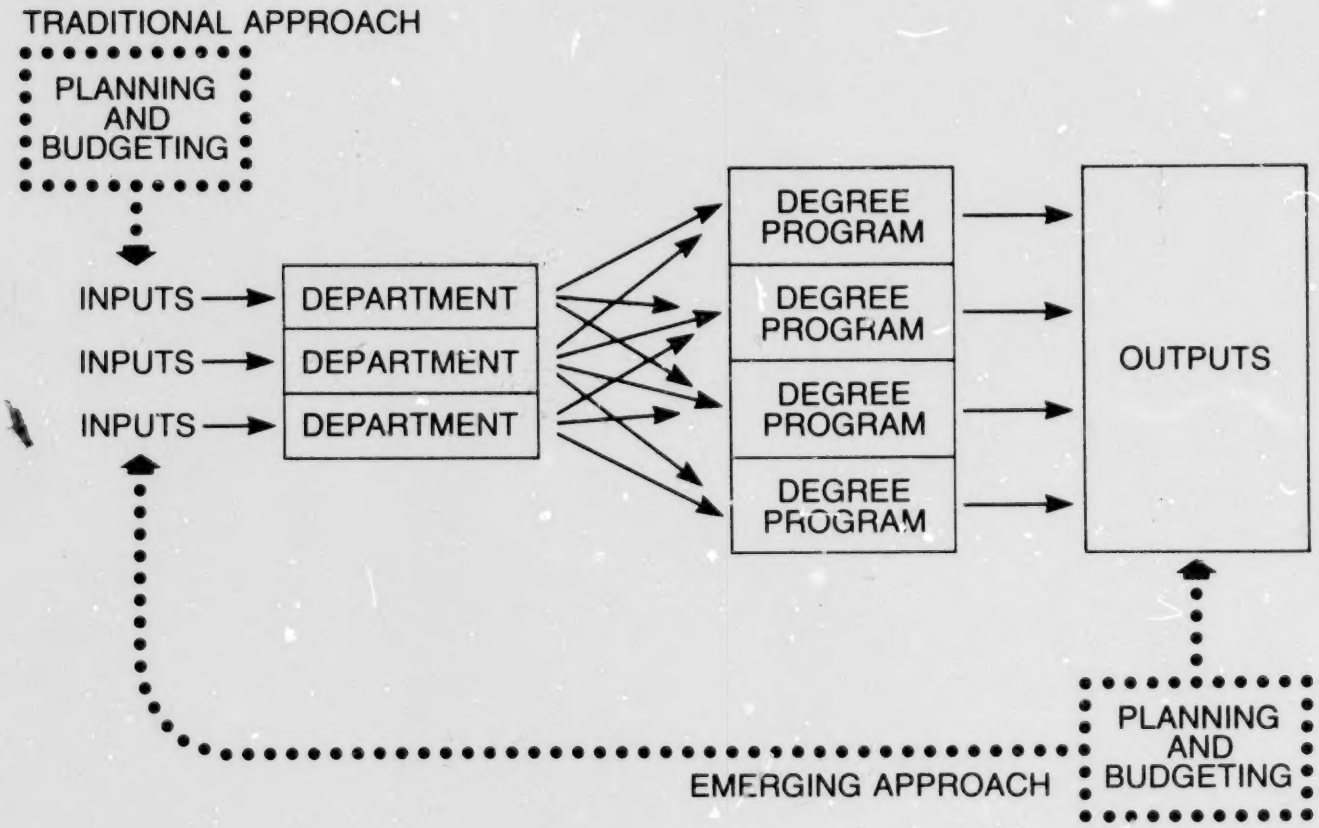
The National Center for Higher Education Management Systems (NCHEMS) has been in existence for some time. Therefore, it seems appropriate to ask such questions as, How is NCHEMS doing, or more importantly, Is the planning and management process in higher education changing? We think the answer to the latter question is yes, educational planning and management innovations are beginning to appear. We hope the NCHEMS effort is partly responsible for this change.

The changing concepts of educational management are being adopted because of a number of pressures related to the need to meet many demands for educational services in an environment of constrained resources. The work of the National Center is timely in that it coincides with the perceived need for improved management methodologies. Management by objective and program budgeting concepts are no longer nebulous theories to the rank and file of administrators. Yesterday's speculations about innovations in educational administration are about to become tomorrow's realities.

MR. AVERAGE COLLEGE PRESIDENT 1960's

Mr. Average College President of the 1950's and early 60's had different types of problems than his present day counterpart. Money was flowing into higher education from a variety of sources. Few people were asking hard questions about how funds were being used and what specific outputs were being produced. Higher education was assumed to be a fundamentally sound investment, and few expenditures of public and private funds were thought to reap as high a return for the general society as the educational investment. Operating in such an environment, educational managers concentrated their planning and budgeting efforts on defining the amounts of resources needed as inputs to the various organizational units that comprise colleges and universities. Little effort was given to answering the question, Needed for what?

THE CHANGING APPROACH TO HIGHER EDUCATION
PLANNING AND BUDGETING



Planning and budgeting based on inputs has been the traditional approach. The traditional line-item budget defines the amount of resources required by each of the organizational units (i.e., departments) of an institution. A traditional line-item budget does not relate dollar inputs to outputs. Now, many projects are competing for public and private dollars. A question commonly posed is, Are the products of higher education worth the cost? The public is wondering whether it is better to build low-cost housing or reduce pollution than to produce more degrees. Educational administrators must address these questions. They are being asked to justify the cost of educational outputs, and this demand is fostering an emerging approach to planning and budgeting. In this new approach management must establish its output goals, formulate programs intended to produce those outputs, and finally conduct analyses to define the quantity and mix of resources that must be input to each organizational unit to ensure each program's success. Thus, academic planners are increasingly aware of the fact that resources flow into instructional departments only because departments contribute to various degree programs. Currently, many funding agencies are requesting budget formats that link resource requests directly to programs that produce outputs.

MR. AVERAGE COLLEGE PRESIDENT 1970's

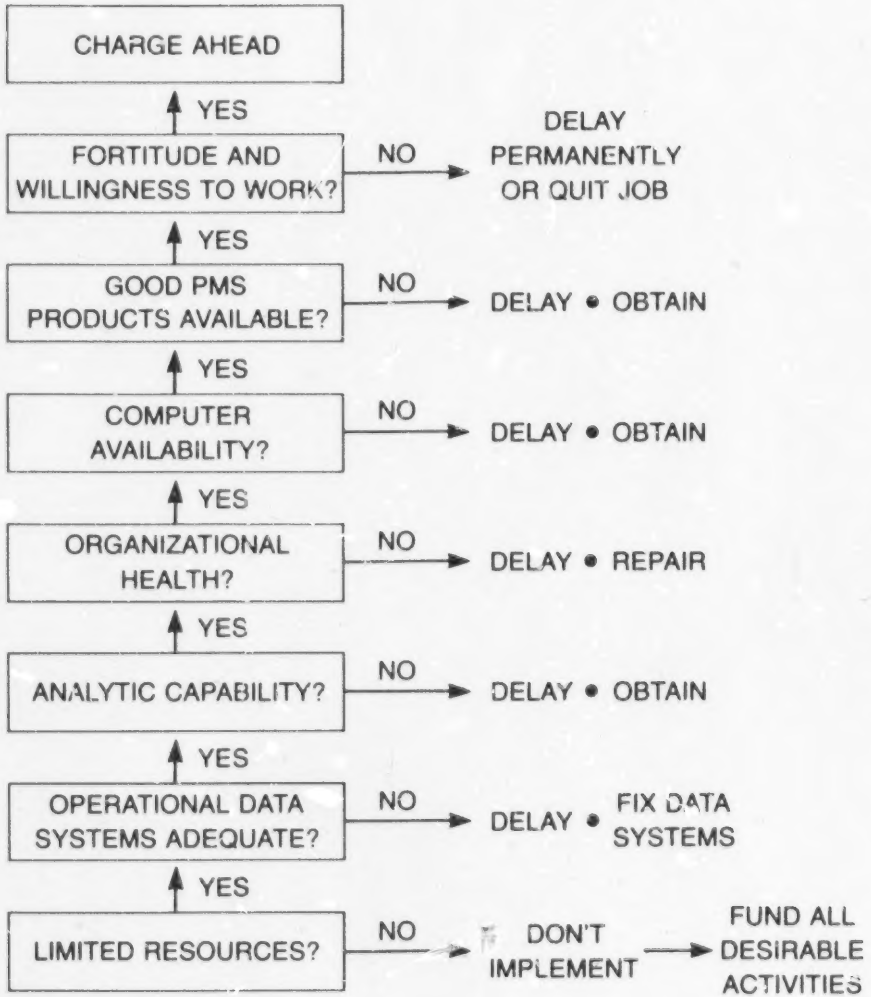
PRESSURES
FOR PMS
IMPLEMENTATION

- NEED FOR BETTER INSIGHT INTO INSTITUTIONAL PRODUCTION FUNCTIONS
- NEED TO OPTIMIZE LIMITED RESOURCES
- INCREASING DEMAND FOR PROGRAM ACCOUNTING AND PROGRAM BUDGETING

When we observe Mr. Average College President of the 1970's, we see that he is under more pressures, or at least different pressures, than his counterpart of the 1960's. He is being encouraged on many sides to implement planning and management systems in order to gain an improved understanding of how his institution actually operates and produces outputs. He is told that the new kinds of information derived from such a system can help him more effectively use his limited resources as well as satisfy the increasing demands for program cost accounting and budgeting information. He is inclined to believe that planning and management systems will help, but he wonders how he should proceed and how he can determine his institution's PMS capability to implement new planning and management systems.

DECISION TREE FOR PMS IMPLEMENTATION

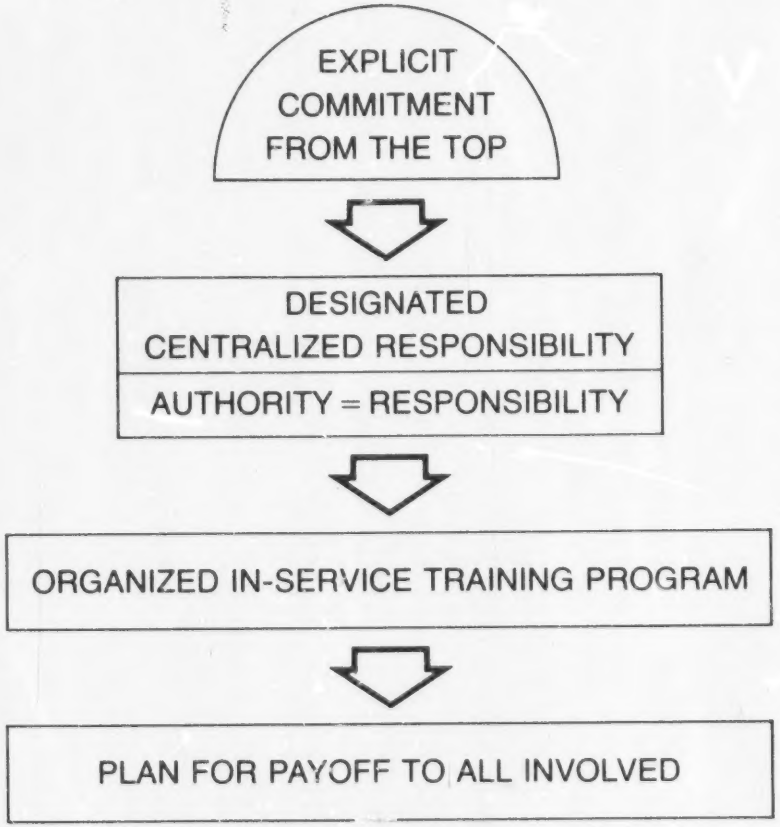
TO IMPLEMENT?
OR
NOT TO IMPLEMENT?



Those who are considering planning and management system (PMS) implementation must first decide if such systems are really needed. If an institution has unlimited resources and there are sufficient funds available for all desirable activities, planning and management systems are not required. Today, few educators enjoy such luxury, and most are facing difficult decisions concerning which programs among a large number of worthy activities will be funded.

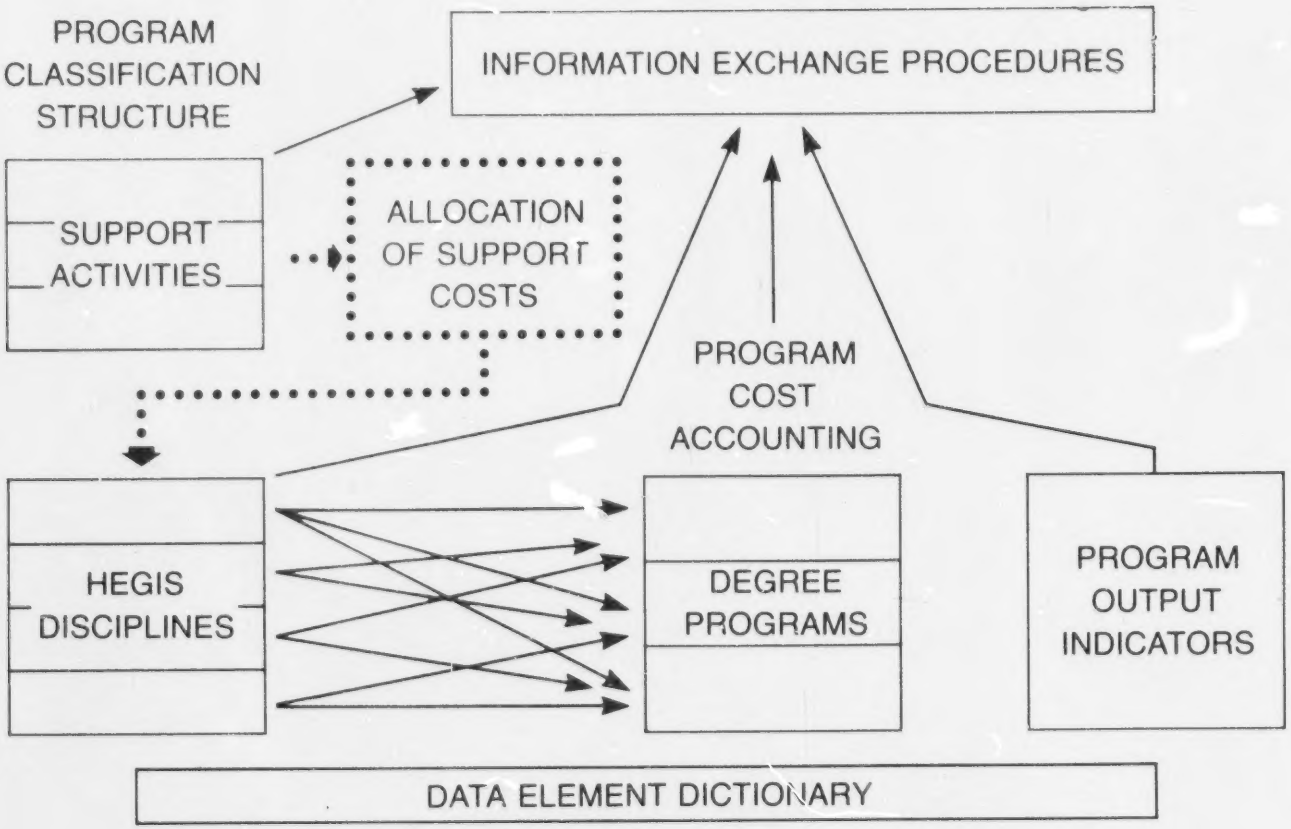
Having decided that planning and management systems are desirable, an institution cannot proceed with PMS implementation unless specific prerequisite elements are present. The institution must have operational data systems from which the required data base can be derived. Personnel are required who have the analytic capability to learn about and maintain planning and management systems. The institution's organizational health must be such that it can smoothly incorporate the necessary changes for implementation. This will require a great deal of cooperation from many areas of the campus. Computer availability is necessary to manipulate data rapidly. Good PMS tools and techniques must be readily available. These tools must be complex enough to accommodate the institution's needs and still be relatively easy to install and use. Finally, successful implementation will never occur without fortutide and willingness to work. PMS implementation requires a good deal of effort as well as commitment of resources to the implementation tasks.

ORGANIZING FOR PMS IMPLEMENTATION



A great deal of attention should be given to the manner of organizing for implementation of planning and management systems. Gaining explicit commitment from top executive management is of primary importance. All those who are to play a part in PMS implementation must be aware of that commitment. Specific individuals must be designated as having centralized responsibility for the implementation task, and it is important that they also be given sufficient authority to enable them to fulfill their responsibility. Many individuals and offices throughout the institution will be required to cooperate in data collection. All of these individuals can be expected to cooperate more freely if they understand the reason for the PMS undertaking and perceive that there will be some relative advantage under the new systems for the institution as a whole, as well as for themselves. Such understanding will require an in-service training program within the institution in order that all those involved know not only what they are required to do but also why they are being asked to do it.

SELECTION OF PMS TOOLS
TO GATHER HISTORICAL INFORMATION



PMS tools fall into two general categories: (1) those that are used to gather historical data, and (2) those that use the historical data as a point of departure to project future costs and assist in planning for future operation. The diagram above displays some PMS tools concerned with historical data collection.

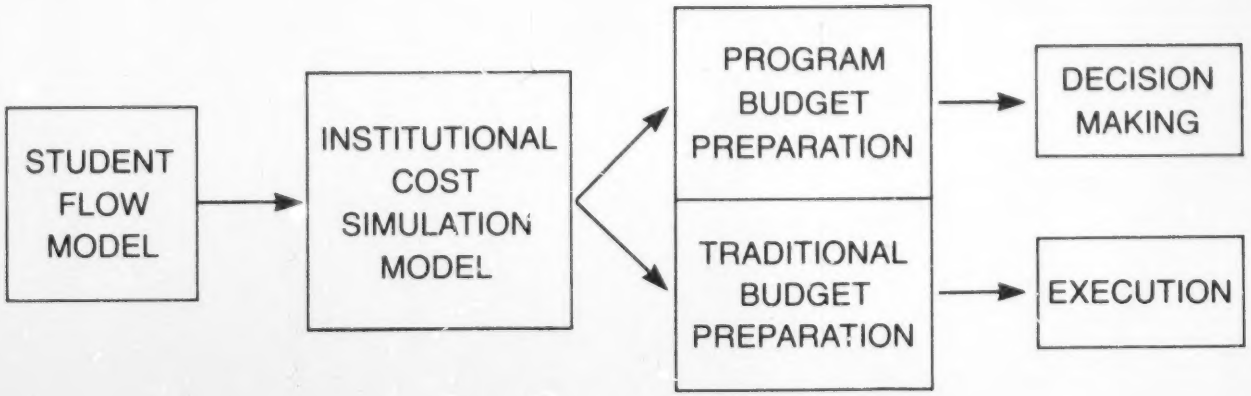
Institutions that wish to gather their historical data for comparative purposes will find the NCHEMS Program Classification Structure (PCS) a valuable asset. The PCS provides cost centers for the primary and support activities of an institution. It may be viewed as a common filing structure to which various kinds of data may be attached. The PCS cost centers in the instructional area consist of a list of disciplines that correspond to the reporting categories required by the Higher Education General Information Survey (HEGIS). Institutional data may be translated into the NCHEMS PCS in preparation for reporting to the USOE through HEGIS.

If an institution determines the cost of instruction in each discipline, degree program costs may be obtained by allowing the dollars to flow from the discipline cost centers to the various degree program cost centers in proportion to the flow of credit hours from disciplines to degree programs. For example, the history discipline costs would flow proportionally to each degree program as students from the various degree programs take credits in the history discipline. If support costs were previously allocated to the disciplines, then these costs would also flow to the degree program cost centers along with the direct instructional costs and would be calculated as part of the total cost of each degree program.

Two additional areas of concern are program output indicators and information exchange procedures. If cost benefit analysis is to be applied to an institution, good program output indicators are necessary. Likewise, costing and output studies must be performed under precisely the same set of procedures if information exchange is to have any validity. Both of these areas are receiving a great deal of attention and will continue to be researched over the next few years.

SELECTION OF PMS TOOLS FOR PROJECTION AND PLANNING

INSTITUTIONAL
OBJECTIVES

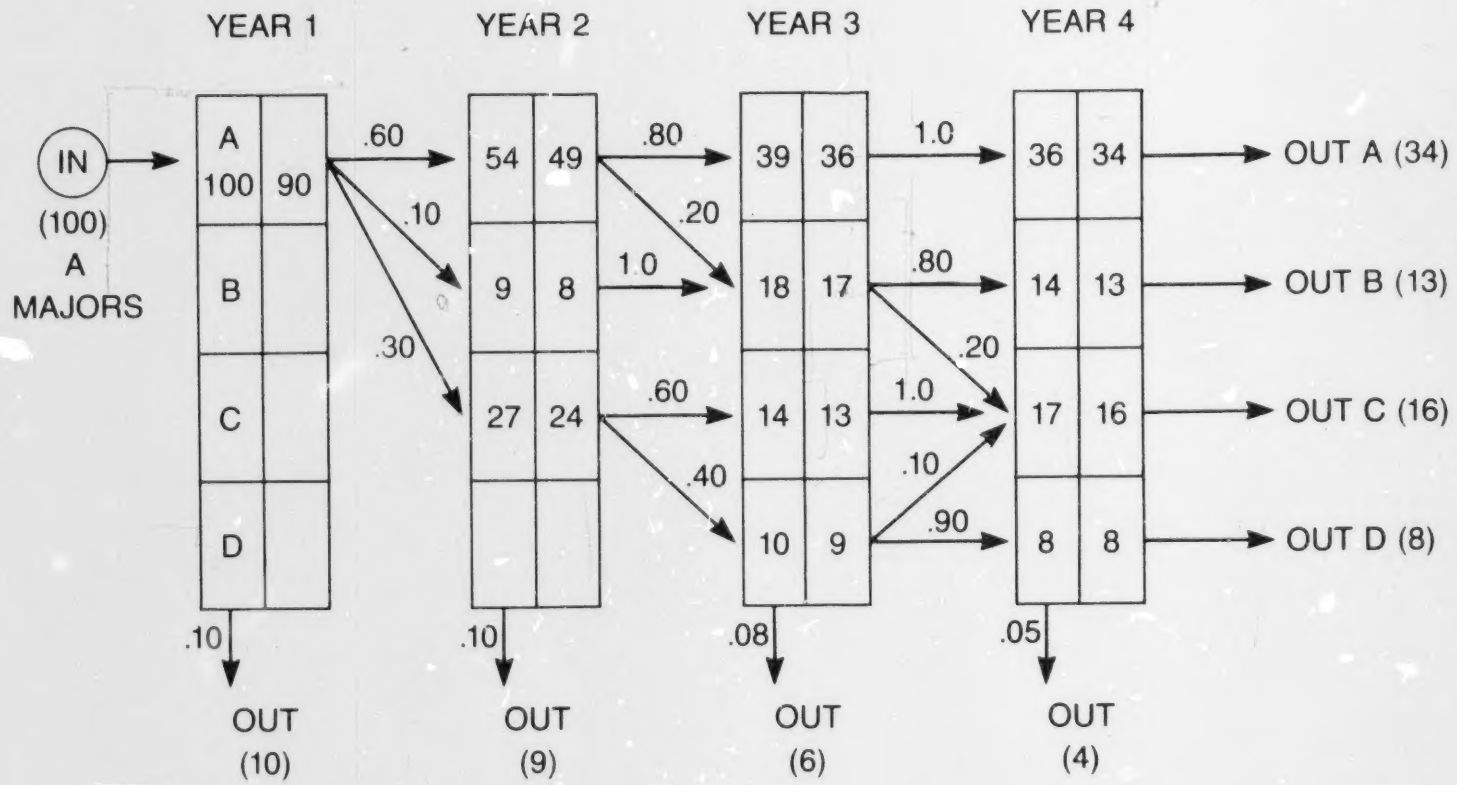


Once an institution knows its current program costs and outputs, it has a base on which to plan for future operations. Various alternative plans can be developed that will lead the institution toward its objectives. Student flow models and cost simulation models can be very helpful at this point in evaluating various plans and in predicting the long-range resource requirements that are being committed by current decisions.

Student flow models may be used to project student enrollments by major and by student level within the institution. This is valuable information that serves as a principal input to a cost simulation model. NCHEMS cost simulation models use student enrollments and planning parameters related to faculty, classes, support staff, supplies and equipment, etc., to forecast in a program budget format the resources required when the institution is operated in accordance with a variety of alternative plans.

Using a program budget, decision makers can compare the costs of various alternatives and weigh these costs against the anticipated benefits of the various alternatives. In addition, PMS tools may be used to generate a traditional budget that will show the flow of resources to various departments as required to implement a desired set of programs. Thus, PMS tools are able to generate program budgets for program decision making and traditional line-item budgets for program execution.

STUDENT FLOW FOR TYPE A MAJORS



A student flow model may take different forms. The NCHEMS model uses transitional probabilities to forecast the flow of students between majors from one year to the next. In the example above, 100 type A majors enter the institution in Year One. During Year One, ten percent leave the institution. Of those students that remain, sixty percent continue as type A majors in Year Two; ten percent switch to type B majors; and thirty percent switch to type C. This same cycle repeats itself through Year Four, producing, in this example, 34 type A graduates; 13 type B graduates; 16 type C graduates; and 8 type D graduates.

Obviously, good predictions from this model are dependent on valid and reliable transition probabilities. Tests have been completed that demonstrate the advantage of this approach to forecasting student flow. NCHEMS, in corperation with pilot institutions, is researching various methods of developing and using student flow models.

A great advantage of the type of student flow model shown above is its flexibility. The flow of various student categories (male, female, minority groups) may be examined individually. The attrition rates of different majors may be compared. The effect of changing admission policies related to certain types of students can be examined and analyzed. Through the use of a student flow model, the educator can understand better what is happening to different groups of students as they pass through his institution. This improved understanding can lead to efforts to shape the institution to offer the best possible service to various categories of students.

INDUCED COURSE LOAD MATRIX

AVERAGE STUDENT MAJOR

PROGRAMS

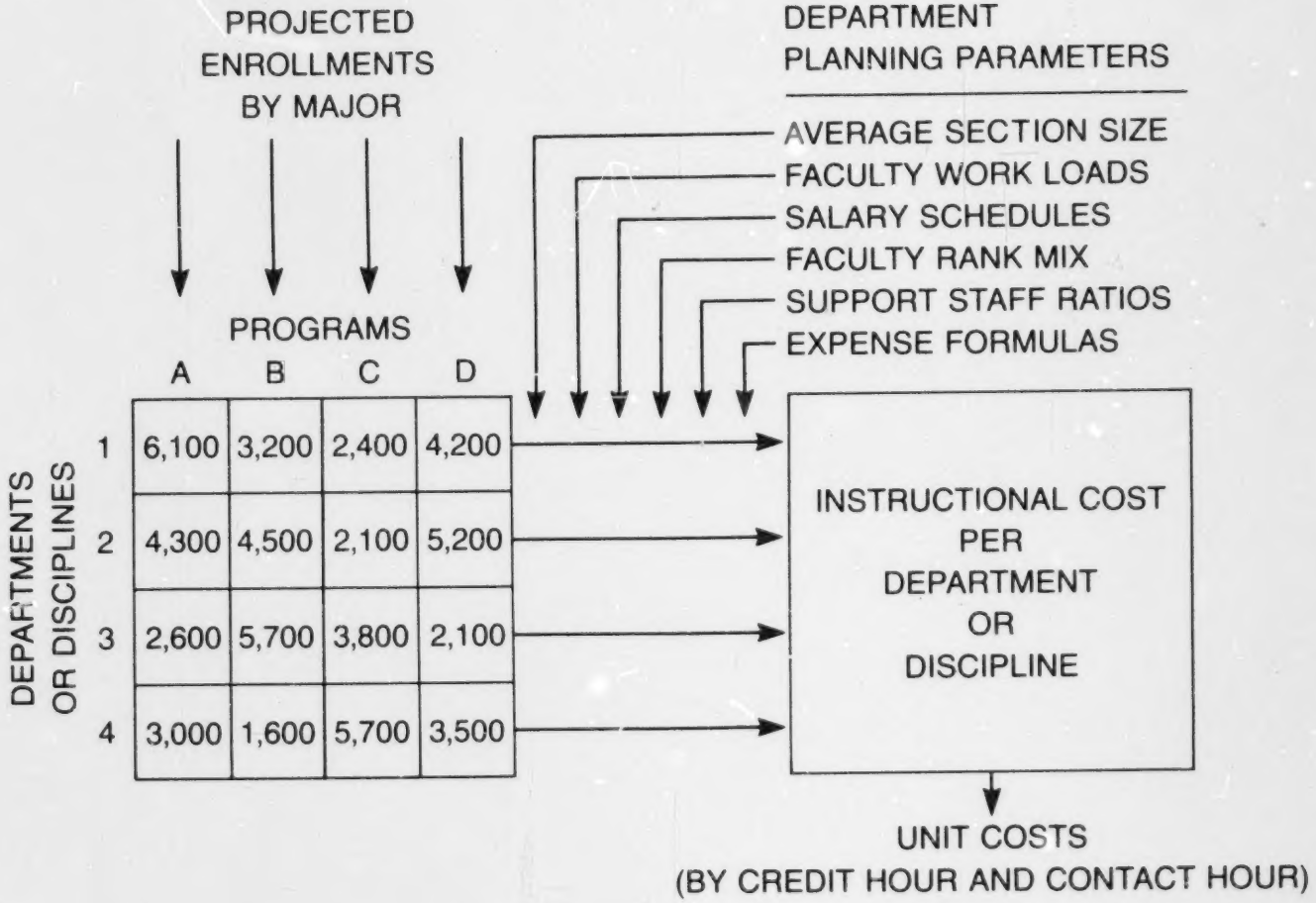
DEPARTMENTS OR DISCIPLINES	A	B	C	D
1	6.1	3.2	2.4	4.2
2	4.3	4.5	2.1	5.2
3	2.6	5.7	3.8	2.1
4	3.0	1.6	5.7	3.5
	16	15	14	15

One of the foundation blocks of a cost simulation model is an Induced Course Load Matrix (ICLM). This matrix displays the load induced in each discipline or department by an average major of each type. The Induced Course Load Matrix displayed above shows the number of credit hours in each discipline or department taken by the average student enrolled in each of the degree programs of the institution. For example, the average type A major can be expected to take 6.1 credit hours in Discipline One, 4.3 credit hours in Discipline Two, 2.6 credit hours in Discipline Three, and 3.0 credit hours in Discipline Four. If one hundred type A majors are admitted to the institution, it can be readily ascertained that the load induced on Discipline One will be 610 credit hours; the resulting load in Discipline Two will be 430 credit hours, and so forth. Thus, any given set of enrollment projections may be multiplied down through the Induced Course Load Matrix to determine the total estimated credit hour load that will be demanded of each of the disciplines or departments in the institution.

COST SIMULATION MODELS

HOW DO THEY WORK?

(PHASE I)

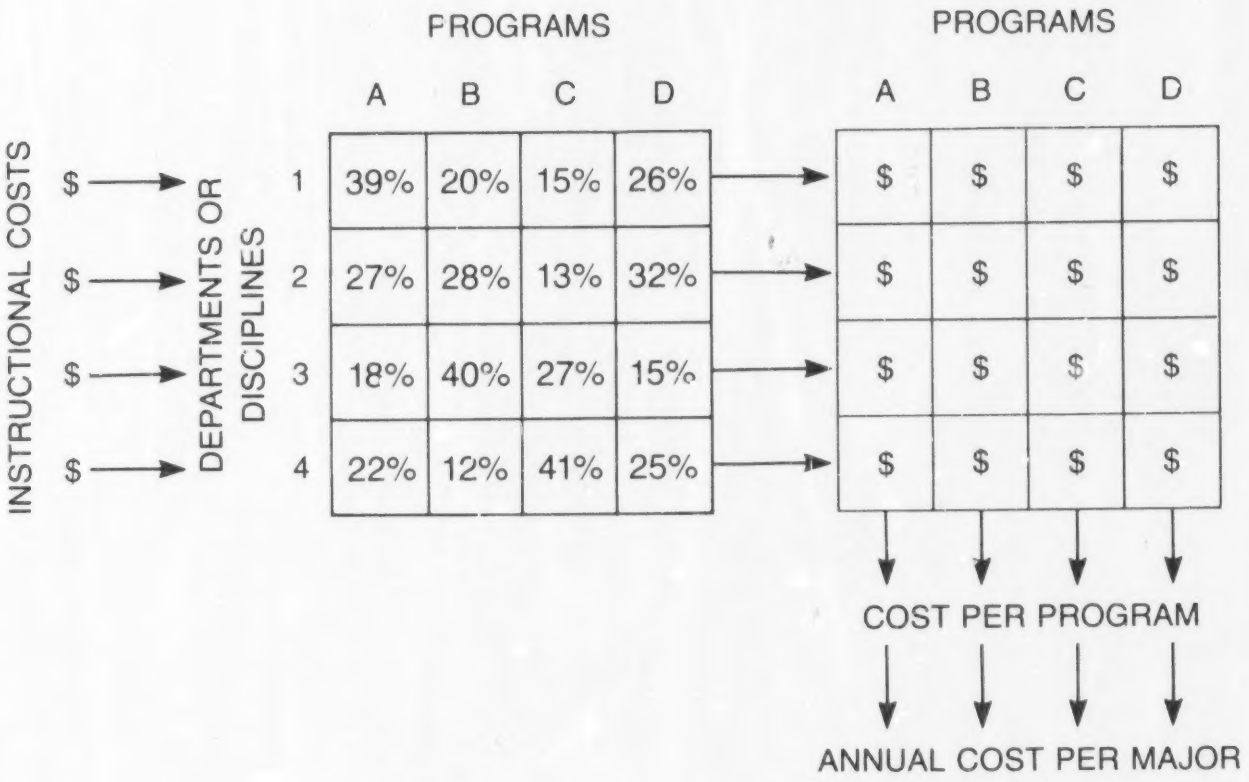


When the projected enrollments have been multiplied through the Induced Course Load Matrix, the predicted credit hour demand in each discipline or department induced by each type of major is known. Summing across the matrix containing the credit hour loads induced by each type of major gives the total credit hours that a department must produce. Various planning parameters may then be input to describe how each department's instructional function will be operated. Parameters such as average section size, faculty work load, salary schedules, support staff ratios, and expense formulas have substantial resource implications. Once the department planning parameters are established and the student enrollments are known, the projected department costs are calculated. The cost per credit hour may then be derived by dividing the total instructional cost of each department by the total credit hours to be produced. Cost comparisons between departments are very difficult at best because of different departmental roles and missions. However, if cost comparisons are desired, they are most appropriately made using cost per credit hour (or contact hour), since this eliminates the effect of size difference between departments.

COST SIMULATION MODELS

HOW DO THEY WORK?

(PHASE II)



Having determined the instructional cost for each department, a cost simulation model will proceed to distribute those department costs to the various degree programs in direct proportion to the number of credit hours drawn from each department by each degree program. The workload induced in a given department by majors in a specific type of program represents a percentage of the total workload of that department. If the percentages for each department are added horizontally, they will equal 100 percent. Each percentage will represent a degree program's contribution to the total workload of a particular department. The instructional costs of each department may be distributed across the various programs in accordance with the derived percentages and placed in another matrix. The cost of each degree program is calculated by summing all the dollars in a column of this final matrix. Thus, the cost of degree program A is obtained by summing all the dollars in column A. The annual cost per major is a useful unit for comparing degree program costs and is obtained by dividing the total cost of a degree program by the number of majors.

This entire view of cost simulation models can be expanded from two dimensions to four dimensions. The expanded model handles student levels within degree programs (lower division, upper division, and graduate) and different instruction levels (lower division, upper division, and graduate). Such an expanded model provides costs for each discipline at different levels of instruction and for each degree program at different levels of student major.

WHAT DOES A PROGRAM BUDGET LOOK LIKE?

INSTRUCTIONAL PROGRAMS	ANTICIPATED NUMBER OF STUDENT MAJORS	ANNUAL COST PER MAJOR	TOTAL DIRECT INSTRUCTIONAL COSTS
HISTORY			
LOWER DIVISION	228	$ 873	$199,044
UPPER DIVISION	186	1,096	203,856
GRADUATE	91	1,309	119,119
			$522,019

DEPARTMENT PLANNING
PARAMETER INFORMATION

AVERAGE SECTION SIZE
FACULTY WORK LOADS
FACULTY PRODUCTIVITY RATIOS
SALARY AND WAGE SCHEDULES
MIX OF FACULTY RANKS
RATIO OF SUPPORT STAFF TO FACULTY
EXPENSE FORMULAS

A program budget can be constructed in a variety of formats; however, there are certain kinds of information that will almost always be included. The sample format above displays the direct instructional costs for the history degree program at lower division, upper division, and graduate levels. The total direct instructional cost is a result of the annual cost per major and the anticipated number of majors. If these numbers are accurate, the total direct cost is an inevitable consequence. Thus, any negotiation or justification pertaining to a program budget must center on the number of students to be admitted and the annual cost per major. The number of students may be set by policy, or if not limited, predicted by a student flow model. The annual cost per major is a consequence of planning parameter decisions (displayed as back-up information in a program budget). Once it is determined what the average section size, faculty work load, salary schedule, expense formulas, etc., will be, and the number of students is known, the annual cost per major and total cost of each degree program are calculated by means of a cost simulation model. When the costs used to prepare a program budget are deemed reasonable and valid, yet not enough funds are available for all desirable programs, institutional priorities must be established. The anticipated outputs or benefits of the various programs must be compared and weighed against costs in order to establish which programs will be diminished or nourished.

A program budget is not a panacea. It cannot be expected to make decision making easier. Rather, it displays resource requirements in relation to output-generating programs and provides greater insight into what we are buying with our educational expenditures.

OUTPUT ACCOUNTING

WHEN? HOW?

INSTRUCTION VARIABLES	MEASUREMENT TECHNIQUES
RESEARCH VARIABLES	MEASUREMENT TECHNIQUES
COMMUNITY SERVICE VARIABLES	MEASUREMENT TECHNIQUES
INSTITUTIONAL ENVIRONMENT VARIABLES	MEASUREMENT TECHNIQUES

PSYCHOMETRIC TESTS

CONTROL GROUPS

VALIDATION TECHNIQUES

VALUE ADDED CONCEPT

INSTITUTIONAL RECORDS

FACULTY ACCEPTANCE

PILOT TESTS

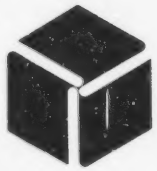
SAMPLING TECHNIQUES

STUDENT QUESTIONNAIRES

STUDENT COOPERATION

Output accounting is an essential complement to program accounting and program budgeting. The Research Group at NCHEMS is currently exploring the area of output accounting. An attempt is being made to establish a list of variables (related to instruction, research, community service and the institutional environment) which, if measured, would provide a comprehensive profile of the institution and its outcomes. Only through trying a wide variety of approaches in pilot institutions will we be able to increase our understanding of what is possible, feasible, and desirable insofar as institutional output accounting is concerned. In this area, it is certainly true that progress will come slowly and in small increments.

With the increase in cost information related to educational programs on various campuses, it becomes imperative that improved means of assessing the relative merits and varying purposes of programs be developed. Without improved output accounting, there is grave danger that funders may fail to recognize basic differences among groups of degree programs with similar names and may be tempted to hastily proclaim that cheap is best.



NCHEMS

RESEARCH	DEVELOPMENT AND APPLICATIONS	TRAINING AND IMPLEMENTATION

ACCOUNTABILITY AND COMMUNICATION PROJECTS

1. DATA ELEMENT DICTIONARY
2. PROGRAM CLASSIFICATION STRUCTURE
3. COST FINDING PRINCIPLES
4. FACULTY ACTIVITY ANALYSIS
5. OUTPUT INDICATORS
6. MANPOWER ACCOUNTING MANUAL
7. HIGHER EDUCATION FINANCE MANUAL
8. HIGHER EDUCATION FACILITIES MANUAL
9. INFORMATION EXCHANGE PROCEDURES
10. STATEWIDE PLANNING SYSTEMS

PLANNING AND ANALYSIS PROJECTS

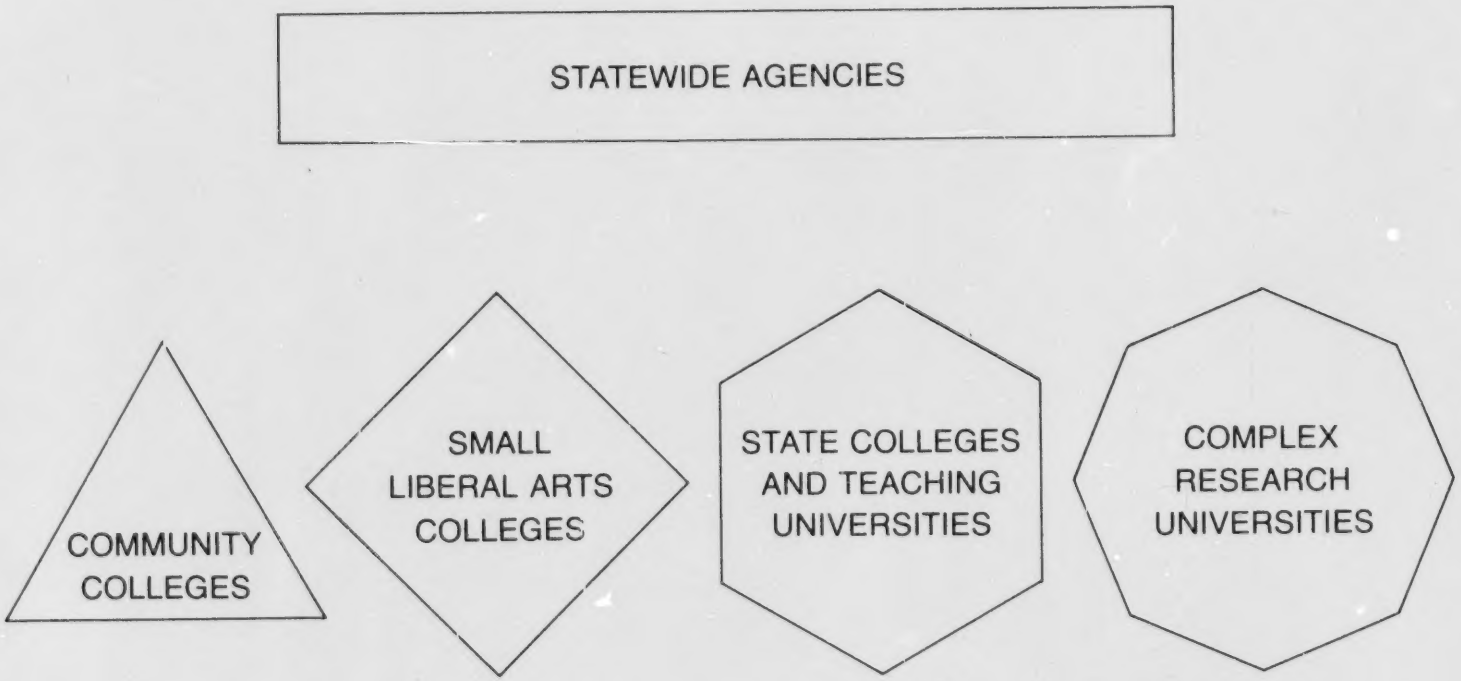
1. STUDENT FLOW MODEL
2. RESOURCE REQUIREMENTS PREDICTION MODEL
3. HIGHER EDUCATION FACILITIES PLANNING MANAGEMENT MANUALS

There are three overlapping functions within the NCHEMS organization, Research, Development and Applications, and Training and Implementation Assistance. The Research Group is responsible for generating the conceptualized products. Those conceptualizations are then passed on to the Development and Applications Group where documents and software are written and pilot tests are conducted. The Training and Implementation Group is responsible for displaying and explaining the various NCHEMS products and for assisting those institutions which decide to adopt specific PMS tools in preparing for the implementation tasks.

NCHEMS projects may be divided into two categories, those that deal with the accountability function and procedures for communication among institutions and those that are related to institutional planning, analysis and projection. Some of the currently-funded projects are listed above. Several additional projects are currently being developed at NCHEMS, and it is expected that the list presented here will be extended in the future.

The National Center exists to serve the needs of higher education. As additional needs are identified, NCHEMS can be expected to take whatever action is possible within the limits of its resources. Of special concern in the future will be the development of statewide planning and management systems, investigation of special applications of PMS products at small colleges, and the development of planning tools and techniques for academic administrators at the department and division levels.

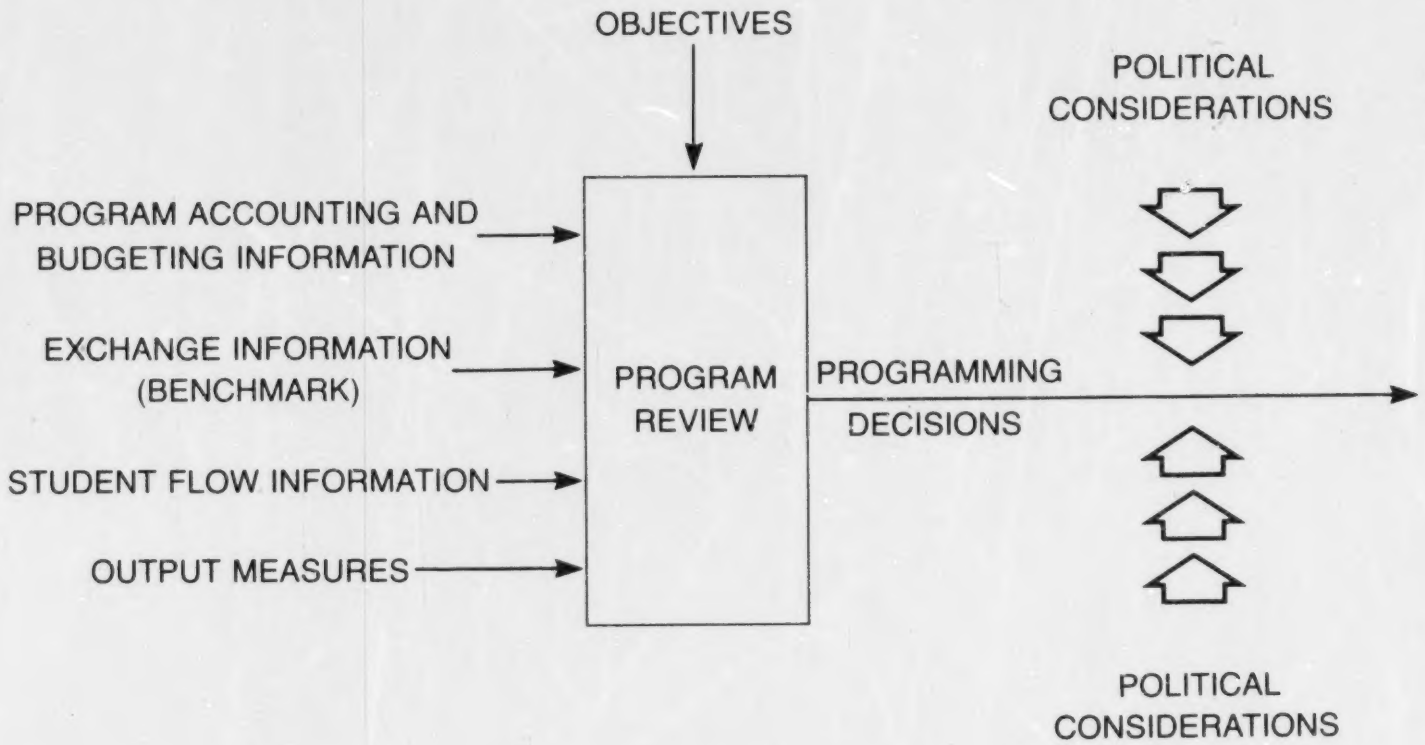
UNIQUE INSTITUTIONS
UNIQUE PROBLEMS



An important consideration of NCHEMS is the wide variety of institutions that it is attempting to serve. Each institution has unique needs and problems. The PMS tools developed at NCHEMS must have the flexibility to serve various types and sizes of higher education organizations. NCHEMS is guided and controlled by the institutions and agencies of the higher education community.

It is a collective, cooperative undertaking in which institutions and NCHEMS staff are learning together. Some false starts, some errors in direction will inevitably be made. However, with a great deal of honest effort and a spirit of cooperation, NCHEMS hopes to succeed in adding an element of management science to the art of educational administration.

A NEW ENVIRONMENT FOR PROGRAM REVIEW



The theme of this document and the entire NCHEMS endeavor is that programmatic decision making can be carried out effectively only if appropriate kinds of information are made available. If an institution knows it's objectives, it can define a course of action for the years ahead. Through use of a cost simulation model, it can forecast the resource implications of that plan. Student flow information will indicate which programs exhibit holding power and are most relevant to the needs and interests of the student population. Output measures can provide information related to the benefits or the value added to students and can be useful in identifying needed mid-course corrections in program design.

Planning and management systems can improve the management of resources allocated to higher education. PMS will not make decision making easy or eliminate political considerations. Political considerations and pressures will never cease to exist, but they may be tempered in the future by the creation of more objective information. Higher education institutions will be difficult to manage even with the availability of the best planning and management systems information. Without such information, good management at a complex institution may be virtually impossible.

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